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civilizations and the racial and linguistic characteristics of the Philippine peoples, placing the whole in an adequate geographical setting. The paragraphs on population density and distribution (accompanied with map based on the census of 1903) are specially interesting.

Population even in pre-European times was comparatively dense. The lowest computation gives five per square mile, a figure greater than that for any parts of the aboriginal New World except parts of Mexico and Peru. Under Spanish rule population increased in the main because of removal of social causes militating against increase—piracy, human sacrifice, head hunting, etc. Comparatively little was done to render more land available for cultivation or to improve the yield from cultivated areas. The possibilities in these latter directions are enormous. The subprovince of Ifugao in the interior of northern Luzon, with an area of some 750 square miles of which less than 50 square miles are actually cultivated, is estimated to contain 132,000 inhabitants. This means that more than 2,000 people are supported by each square mile of cultivated land—a density rendered possible by the skilled works of terracing and irrigation that are astonishing achievements for so distinctly primitive a tribe as the Ifugao.

VEGETATIONAL STUDIES ON PHILIPPINE MOUNTAINS

WILLIAM H. BROWN. **Vegetation of Philippine Mountains: The Relation Between the Environment and Physical Types at Different Altitudes.** 434 pp.; map, diagrs., ills., index. *Manila Bur. of Science Publ. No. 13*, Manila, P. I., 1919. 9½ x 6 inches.

As the title implies, this is an attempt to relate the vegetation of different altitudes to the environment by measurement of the various climatic and soil factors. Most of the study is devoted to Mt. Maquiling, an isolated extinct volcano, 1,140 meters high, situated 64 kilometers southeast of Manila. A briefer study was also made on Mt. Banahao, 2,300 meters (pp. 391–405).

The vegetation of the slopes of Mt. Maquiling is divided into four types as follows: (1) *parang*, a Tagalog term for mixture of second-growth forests and grassland in early stages of recovery from former clearings, around the base of the mountain and extending up the slopes to an altitude of 200 meters; (2) dipterocarp forest, from the edge of the *parang* to an altitude of 600 meters; (3) mid-mountain forest, from 600 meters to 900 meters; and (4) mossy forest, on the top of the mountain and bathed in clouds for a large part of the time. A general description is given of each one of the vertical zones of vegetation.

Small plots, usually .25 hectare in area, are laid out, and a census of the vegetal population is taken. In this census, probably the most complete ever taken in a tropical forest, the well-known arrangement of the forest into stories is recognized, and the number of tree species of each story is recorded. For instance in the dipterocarp forests three stories are thus enumerated. The height of the tree, its diameter, and the length of the bole are measured; and from these data the volume of the wood is obtained. These figures show that, while the plot contains 92 species, only a few of them have the capacity to reach, when mature, the upper story, making it comparatively simple in composition. This is a confirmation of the investigation of the writer of this review made in tropical forests of both hemispheres and is of great importance from the standpoint of the lumberman, for trees of the upper story are usually the only ones of sufficient size to utilize on a large scale.

As one ascends any tropical mountain, it will be noticed that the height of the forest and the number of stories diminish. Brown's measurements show that in the dipterocarp forests (three stories) the tallest tree is about 40 meters and the average height of the top story is 27 meters; in the mid-mountain forest (two stories) the tallest tree of the first story is 22 meters and the average height is near 17 meters; while in the mossy forest (one story) the tallest tree is 13 meters and the average height is about 6 meters.

In order to explain, if possible, the interrelations of the different classes of vegetation at the same and at different altitudes extensive measurements of the environmental factors were made at five stations at different altitudes. In this way comprehensive data, more complete than ever before undertaken in any tropical country, were obtained of the temperature, light intensity, rainfall, soil moisture, humidity, evaporation, and wind velocity. In some instances instruments in the same station were set up at different heights from the ground, thus giving data concerning the local climate in different layers of the atmosphere. The readings extended over a period of some two years.

Some of these results may be briefly indicated. As one would suppose, the temperature decreases from the lower altitudes to the higher. The average daily maximum is as follows: at 80 meters, 29.2° C.; 300 meters, 25.1° C.; 450 meters, 24.3° C.; 740 meters, 23° C.; 1,050 meters, 19.3° C. Owing principally to more frequent cloudiness at the higher altitudes the light intensity decreases from the base of the mountain to the top. The average daily light intensity in tops of dominant trees at different elevations, as measured by the difference between the evaporation from the white and from the black Livingston atmometer, is as follows: at 80 meters, 6.4; 300 meters, 5.9; 450 meters 5.1; 740 meters, 4.; 1,050 meters, 2.8. These figures show that the light intensity is 2.3 times as great at the base as at the top. The rates of growth and the heights of the trees at different elevations show a general agreement with the light-temperature indices; viz., with the product of light intensity multiplied by temperature indices for growth. In fact, Brown thinks that the lower temperatures and the lower light are the main factors in producing the lower growth of the higher altitudes. Of these the diminished light of the higher altitudes of Mt. Maquiling has, according to the author, the most influence; for the differences in temperature are not great enough to have an appreciable effect. Rainfall is greatest at the middle elevations, while evaporation decreases with altitudinal increase. The moisture content of the soil increases with altitude. At the base it is low enough to become harmful for vegetation.

The article is full of interesting discussions, sometimes speculative, although always based on some data and admitting that the conclusions reached must be verified by further studies. The quantitative description of the vegetation and the measurement of the different factors of the habitat are so exhaustive as to leave no doubt that the work has been well done. The records are all published in great detail; for, as the author states, "it is believed they will be of value in presenting an actual picture of environmental conditions, and they may be of service in the future in interpreting the relation of environment to different types of tropical vegetation in a more exact manner than is now possible "

H. N. Whitford

Nature and Man on Cape Cod

A. P. Brigham. **Cape Cod and the Old Colony.** xi and 284 pp.; maps, diagrs., ills., index. G. P. Putnam's Sons, New York and London, 1920. $3.50. 8 x 5½ inches.

Professor Brigham states that his object in writing the story of Cape Cod and the Old Colony was to show "the way men have used these lands and waters and come under their influence," to show "how the first colonists and those who followed them have adjusted themselves to the mobile conditions of nature and of man." This object he has accomplished acceptably, within the limits imposed by space and by the popular audience for which he has written. The physical history of the Cape, with its moraines and outwash plain, its dunes and lakes, its varied and ever changing shore line; the coming of the Pilgrims and the gradual extension of settlements around the Bay; and the changing relations of the people to land and sea through three full centuries—all are woven into a story told in a simple and charming manner for the general reader. Professor Brigham frankly admits that "the Cape cast its spell upon him." Its splendid views, its superb summer air, and its friendly people naturally appealed powerfully to such a lover of nature and of worthy men. And so he is always "sympathetic," perhaps at times unduly so, in his consideration of the activities, character, and outlook of the people of the Cape.

The early colonists were farmers; though most of their settlements were located upon the shores of harbors for purposes of communication and trade, they looked chiefly to the soil for a living, securing for a time good crops of corn and other grains. Where practicable they planted their gardens and fruit trees in the valleys, behind hills, or in kettle holes, as a protection against the ocean winds. Presently, however, agriculture lost its dominance in the economic life of the region, and it continued to decline through many years. Though "too much has been said about the poverty of the Cape soils," it is apparent that from the outset they were relatively poor in many places, and in spite of the use of marine fertilizers their yields decreased because of continuous cropping and of increased wind erosion consequent upon the removal of much of the scanty forest. Other occupations paid better than farming; and, as the population increased, more and more of the people turned to the sea. Increasingly in later years the Cape looked for its food supplies to the interior, with whose rich lands it could not compete in the production of staple crops. Many farmers moved to the prairies, and of late less than a fifth of the Cape has been in farms.